

Cantilever force

This force acts transversely at the centerline of the motor shaft extension. The cantilever force is calculated from the circumferential force multiplied by the pre-tension factor, which is dependent on the mechanical transmission characteristics of the particular belt.

The permissible cantilever forces for the individual motor frame sizes and speeds are specified in Catalog D 81.1. For motors with deep-groove ball bearings, the permissible cantilever force can be increased by replacing the bearings at the drive end with cylindrical roller bearings.

In order to calculate the admissible cantilever forces for a radial load, the line of force (i.e. the centerline of the pulley) of the cantilever force F_Q (N) must lie within the free shaft extension (dimension x).

Dimension x [mm] is the distance between the point of application of force F_Q and the shaft shoulder.

Dimension x_{max} corresponds to the length of the shaft extension. Total cantilever force is calculated using the following equation.

$$F_Q = c \cdot F_U$$

The pre-tension factor c is a value gained from experience from the belt manufacturer. The following approximate value can be assumed.

- For normal flat leather belts with an idler pulley, $c = 2$.
- For v-belts, $c = 2$ to 2.5.
- For special synthetic belts (depending on the type and load), $c = 2$ to 2.5.

The circumferential force F_U (N) is calculated using the following equation.

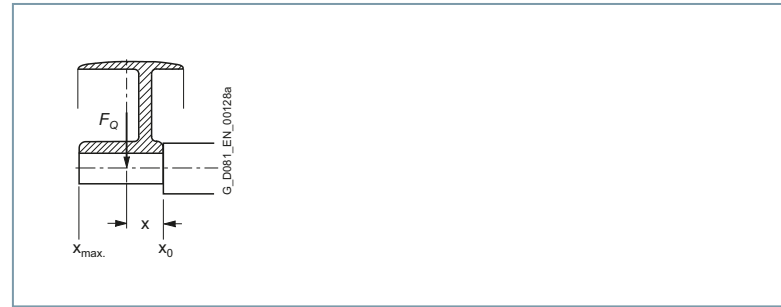
$$F_U = 2 \cdot 10^7 \frac{P}{n \times D}$$

F_U = circumferential force in N

P = rated motor power (transmitted power) in kW

n = rated motor speed

D = pulleys in mm.



Belt drive

A belt drive is used to connect two parallel shafts, the motor shaft with the shaft of the driven machine, whereby the speed can be simultaneously changed corresponding to the ratio between the two belt pulley diameters.

The belt must be pre-tensioned so that it can transmit the circumferential force through friction. The pre-tension factor indicates how much higher the actual tension load (cantilever force) is than the circumferential force (peripheral force).

Today, flat belts are almost always manufactured out of plastic with an adhesive coating (e.g. chrome leather).

Pre-tension factor, approx. 2 to 2.5.

The pre-tension factor for V-belts is approx. 1.5 to 2.5.

The belt must be able to transmit the power at the defined circumferential velocity. This defines the belt thickness and width. The belt supplier specifies the pre-tension factor. The recommended circumferential velocity is approx. 35 m/s for flat belts and approx. 25 m/s for V-belts. Steel belt pulleys must be used for circumferential velocities greater than 26 m/s due to the centrifugal force which occurs.

The actual cantilever force (belt tension) must be compared with the cantilever force permissible for the motor to select the correct motor and bearing sizes.

Bearing – Bearing types

Standard bearing assignment

SIMOTICS Gen									
Frame size	Number of poles	Aluminum Series							
		Efficiency IE1							
		1LA7		1LE1002					
		Drive end	Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)	Drive end	Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)	Drive end	
63	2	6201 2Z C3	6201 2Z C3	6201 2Z C3	-	-	-	-	
	4	6201 2Z C3	6201 2Z C3	6201 2Z C3	-	-	-	-	
	6	6201 2Z C3	6201 2Z C3	6201 2Z C3	-	-	-	-	
71	2	6202 2Z C3	6202 2Z C3	6202 2Z C3	-	-	-	-	
	4	6202 2Z C3	6202 2Z C3	6202 2Z C3	-	-	-	-	
	6	6202 2Z C3	6202 2Z C3	6202 2Z C3	-	-	-	-	
80	2	6004 2Z C3	6004 2Z C3	6004 2Z C3	-	-	-	6004 2Z C3	
	4	6004 2Z C3	6004 2Z C3	6004 2Z C3	-	-	-	6004 2Z C3	
	6	6004 2Z C3	6004 2Z C3	6004 2Z C3	-	-	-	6004 2Z C3	
90	2	6205 2Z C3	6004 2Z C3	6004 2Z C3	-	-	-	6205 2Z C3	
	4	6205 2Z C3	6004 2Z C3	6004 2Z C3	-	-	-	6205 2Z C3	
	6	6205 2Z C3	6004 2Z C3	6004 2Z C3	-	-	-	6205 2Z C3	
100	2	-	-	-	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	
	4	-	-	-	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	
	6	-	-	-	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	
112	2	-	-	-	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	
	4	-	-	-	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	
	6	-	-	-	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	
132	2	-	-	-	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	
	4	-	-	-	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	
	6	-	-	-	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	
160	2	-	-	-	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	
	4	-	-	-	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	
	6	-	-	-	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	
180	2	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	
	6	-	-	-	-	-	-	-	
200	2	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	
	6	-	-	-	-	-	-	-	
225	2	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	
	6	-	-	-	-	-	-	-	
250	2	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	
	6	-	-	-	-	-	-	-	
280	2	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	
	6	-	-	-	-	-	-	-	
315	2	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	
	6	-	-	-	-	-	-	-	
355	2	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	
	6	-	-	-	-	-	-	-	

General Purpose							
Efficiency IE2 1LE1001		Cast Iron Series				Efficiency IE2 1LE0101	
Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)	Drive end	Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)	Drive end	Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
6004 2Z C3	6004 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3
6004 2Z C3	6004 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3
6004 2Z C3	6004 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3	6204 2Z C3
6004 2Z C3	6004 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3
6004 2Z C3	6004 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3
6004 2Z C3	6004 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3	6205 2Z C3
6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3
6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3
6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	6308 2Z C3	6208 2Z C3	6208 2Z C3
6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	6208 2Z C3	6308 2Z C3	6208 2Z C3	6208 2Z C3
6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3
6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	6309 2Z C3	6209 2Z C3	6209 2Z C3
6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	6209 2Z C3	6309 2Z C3	6209 2Z C3	6209 2Z C3
-	-	6210 Z C3	6210 Z C3	6210 Z C3	6210 Z C3	6210 Z C3	6210 Z C3
-	-	6210 Z C3	6210 Z C3	6210 Z C3	6310 Z C3	6210 Z C3	6210 Z C3
-	-	6210 Z C3	6210 Z C3	6210 Z C3	6310 Z C3	6210 Z C3	6210 Z C3
-	-	6212 Z C3	6212 Z C3	6212 Z C3	6212 Z C3	6212 Z C3	6212 Z C3
-	-	6212 Z C3	6212 Z C3	6212 Z C3	6312 Z C3	6212 Z C3	6212 Z C3
-	-	6212 Z C3	6212 Z C3	6212 Z C3	6312 Z C3	6212 Z C3	6212 Z C3
-	-	6213 Z C3	6213 Z C3	6213 Z C3	6213 Z C3	6213 Z C3	6213 Z C3
-	-	6213 Z C3	6213 Z C3	6213 Z C3	6313 Z C3	6213 Z C3	6213 Z C3
-	-	6213 Z C3	6213 Z C3	6213 Z C3	6313 Z C3	6213 Z C3	6213 Z C3
-	-	6215 C3	6215 C3	7215 AC	6215 C3	6215 C3	7215 AC
-	-	6215 C3	6215 C3	7215 AC	6315 C3	6215 C3	7215 AC
-	-	6215 C3	6215 C3	7215 AC	6315 C3	6215 C3	7215 AC
-	-	6317 C3	6317 C3	7317 AC	6317 C3	6317 C3	7317 AC
-	-	6317 C3	6317 C3	7317 AC	6317 C3	6317 C3	7317 AC
-	-	6317 C3	6317 C3	7317 AC	6317 C3	6317 C3	7317 AC
-	-	6319 C3	6319 C3	7319 AC	6319 C3	6319 C3	7319 AC
-	-	6319 C3	6319 C3	7319 AC	6319 C3	6319 C3	7319 AC
-	-	6319 C3	6319 C3	7319 AC	6319 C3	6319 C3	7319 AC
-	-	6319 C3	6319 C3	7319 AC	6319 C3	6319 C3	7319 AC
-	-	6322 C3	6322 C3	7322 AC	6322 C3	6322 C3	7322 AC
-	-	6322 C3	6322 C3	7322 AC	6322 C3	6322 C3	7322 AC

Bearing – Bearing types

Bearing design for increased cantilever forces

SIMOTICS Gen								
Frame size	Number of poles	Aluminum Series						
		Efficiency IE1						
		1LA7	1LE1002					
	Drive end	Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)	Drive end	Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)	Drive end	
63	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
71	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
80	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
90	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
100	2	-	-	-	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3
	4	-	-	-	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3
	6	-	-	-	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3
112	2	-	-	-	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3
	4	-	-	-	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3
	6	-	-	-	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3
132	2	-	-	-	6308 2Z C3	6208 2Z C3	6208 2Z C3	6308 2Z C3
	4	-	-	-	6308 2Z C3	6208 2Z C3	6208 2Z C3	6308 2Z C3
	6	-	-	-	6308 2Z C3	6208 2Z C3	6208 2Z C3	6308 2Z C3
160	2	-	-	-	6309 2Z C3	6209 2Z C3	6209 2Z C3	6309 2Z C3
	4	-	-	-	6309 2Z C3	6209 2Z C3	6209 2Z C3	6309 2Z C3
	6	-	-	-	6309 2Z C3	6209 2Z C3	6209 2Z C3	6309 2Z C3
180	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
200	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
225	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
250	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
280	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
315	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-
355	2	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-



Did you know?

When the load pulls sideways on the shaft, it is called a radial load. A heavy radial load is a belt or pulley drive. If in doubt, it is common to use “C63” or strengthened bearings.

General Purpose		Cast Iron Series					
Efficiency IE2 1LE1001		Efficiency IE1 1LE0102			Efficiency IE2 1LE0101		
Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)	Drive end	Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)	Drive end	Non-drive end (Horizontal mounting)	Non-drive end (Vertical mounting)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3
6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3	-	-	-
6206 2Z C3	6206 2Z C3	6306 2Z C3	6206 2Z C3	6206 2Z C3	-	-	-
6208 2Z C3	6208 2Z C3	6308 2Z C3	6208 2Z C3	6208 2Z C3	6308 2Z C3	6208 2Z C3	6208 2Z C3
6208 2Z C3	6208 2Z C3	6308 2Z C3	6208 2Z C3	6208 2Z C3	-	-	-
6208 2Z C3	6208 2Z C3	6308 2Z C3	6208 2Z C3	6208 2Z C3	-	-	-
6209 2Z C3	6209 2Z C3	6309 2Z C3	6209 2Z C3	6209 2Z C3	6309 2Z C3	6209 2Z C3	6209 2Z C3
6209 2Z C3	6209 2Z C3	6309 2Z C3	6209 2Z C3	6209 2Z C3	-	-	-
6209 2Z C3	6209 2Z C3	6309 2Z C3	6209 2Z C3	6209 2Z C3	-	-	-
-	-	NU210	6210 Z C3	6210 Z C3	NU210	6210 Z C3	6210 Z C3
-	-	NU210	6210 Z C3	6210 Z C3	NU210	6210 Z C3	6210 Z C3
-	-	NU210	6210 Z C3	6210 Z C3	NU210	6210 Z C3	6210 Z C3
-	-	NU212	6212 Z C3	6212 Z C3	NU212	6212 Z C3	6212 Z C3
-	-	NU212	6212 Z C3	6212 Z C3	NU212	6212 Z C3	6212 Z C3
-	-	NU212	6212 Z C3	6212 Z C3	NU212	6212 Z C3	6212 Z C3
-	-	NU213	6213 Z C3	6213 Z C3	NU213	6213 Z C3	6213 Z C3
-	-	NU213	6213 Z C3	6213 Z C3	NU213	6213 Z C3	6213 Z C3
-	-	NU213	6213 Z C3	6213 Z C3	NU213	6213 Z C3	6213 Z C3
-	-	NU215	6215 C3	7215 AC	NU215	6215 C3	7215 AC
-	-	NU215	6215 C3	7215 AC	NU215	6215 C3	7215 AC
-	-	NU215	6215 C3	7215 AC	NU215	6215 C3	7215 AC
-	-	NU317	6317 C3	7317 AC	NU317	6317 C3	7317 AC
-	-	NU317	6317 C3	7317 AC	NU317	6317 C3	7317 AC
-	-	NU317	6317 C3	7317 AC	NU317	6317 C3	7317 AC
-	-	NU319	6319 C3	7319 AC	NU319	6319 C3	7319 AC
-	-	NU319	6319 C3	7319 AC	NU319	6319 C3	7319 AC
-	-	NU319	6319 C3	7319 AC	NU319	6319 C3	7319 AC
-	-	NU319	6319 C3	7319 AC	NU319	6319 C3	7319 AC
-	-	NU319	6319 C3	7319 AC	NU319	6319 C3	7319 AC
-	-	NU322	6322 C3	7322 AC	NU322	6322 C3	7322 AC
-	-	NU322	6322 C3	7322 AC	NU322	6322 C3	7322 AC

Bearing – Cantilever forces

Admissible cantilever forces for standard version

SIMOTICS General Purpose											
Frame size	Number of poles	Aluminum Series						Cast Iron Series			
		Efficiency IE1				Efficiency IE2		Efficiency IE1		Efficiency IE2	
		1LA7		1LE1002		1LE1001		1LE0102		1LE0101	
		for x_0 N	for x_{max} N	for x_0 N	for x_{max} N	for x_0 N	for x_{max} N	for x_0 N	for x_{max} N	for x_0 N	for x_{max} N
63	2	270	240	-	-	-	-	-	-	-	-
	4	350	305	-	-	-	-	-	-	-	-
	6	415	360	-	-	-	-	-	-	-	-
71	2	415	355	-	-	-	-	-	-	-	-
	4	530	450	-	-	-	-	-	-	-	-
	6	630	535	-	-	-	-	-	-	-	-
80	2	485	400	-	-	485	400	620	510	620	510
	4	625	515	-	-	625	515	790	640	790	640
	6	735	605	-	-	735	605	910	740	910	740
90	2	725	605	-	-	725	605	700	560	700	560
	4	920	775	-	-	920	775	880	720	880	720
	6	1090	910	-	-	1090	910	1020	820	1020	820
100	2	-	-	1010	825	1010	825	980	790	980	790
	4	-	-	1230	1010	1230	1010	1230	990	1230	990
	6	-	-	1440	1180	1440	1180	1420	1140	1420	1140
112	2	-	-	970	785	970	785	980	790	980	790
	4	-	-	1235	1000	1235	1000	1230	990	1870	1540
	6	-	-	1440	1165	1440	1165	1420	1140	2140	1720
132	2	-	-	1470	1180	1470	1180	1440	1120	1440	1120
	4	-	-	1830	1470	1830	1470	1820	1420	2720	2170
	6	-	-	2150	1730	2150	1730	2080	1630	3100	2420
160	2	-	-	1550	1270	1550	1270	1560	1240	1560	1240
	4	-	-	1910	1550	1910	1550	1970	1570	3300	2600
	6	-	-	2230	1810	2230	1810	2260	1800	3750	2900
180	2	-	-	-	-	-	-	1820	1470	1820	1470
	4	-	-	-	-	-	-	2300	1900	4000	3300
	6	-	-	-	-	-	-	2630	2150	4500	3700
200	2	-	-	-	-	-	-	2650	2230	2650	2230
	4	-	-	-	-	-	-	3350	2800	5400	4530
	6	-	-	-	-	-	-	3850	3230	6200	5200
225	2	-	-	-	-	-	-	3000	2540	3000	2540
	4	-	-	-	-	-	-	3700	3000	5900	4800
	6	-	-	-	-	-	-	4250	3470	6800	5550
250	2	-	-	-	-	-	-	3150	2620	3150	2620
	4	-	-	-	-	-	-	3950	3280	7350	6100
	6	-	-	-	-	-	-	4600	3820	8450	7000
280	2	-	-	-	-	-	-	6600	5550	6600	5550
	4	-	-	-	-	-	-	8300	6950	8300	6950
	6	-	-	-	-	-	-	9650	8120	9650	8120
315	2	-	-	-	-	-	-	7100	6200	7100	6200
	4	-	-	-	-	-	-	8700	7250	8700	7250
	6	-	-	-	-	-	-	10000	8500	10000	8500
355	2	-	-	-	-	-	-	6800	6000	6800	6000
	4	-	-	-	-	-	-	11500	10000	11500	10000
	6	-	-	-	-	-	-	13200	11600	13200	11600

Bearing design for increased cantilever forces

SIMOTICS General Purpose											
Frame size	Number of poles	Aluminum Series						Cast Iron Series			
		Efficiency IE1				Efficiency IE2		Efficiency IE1		Efficiency IE2	
		1LA7		1LE1002		1LE1001		1LE0102		1LE0101	
		for x_0 N	for x_{max} N	for x_0 N	for x_{max} N	for x_0 N	for x_{max} N	for x_0 N	for x_{max} N	for x_0 N	for x_{max} N
63	2	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-	-	-
71	2	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-	-	-
80	2	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-	-	-
90	2	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-	-	-
100	2	-	-	1585	1300	1585	1300	1480	1220	1480	1220
	4	-	-	1960	1610	1960	1610	1870	1540	1870	1540
	6	-	-	2270	1865	2270	1865	2140	1720	2140	1720
112	2	-	-	1545	1250	1545	1250	1480	1220	1480	1220
	4	-	-	1960	1585	1960	1585	1870	1540	-	-
	6	-	-	2270	1835	2270	1835	2140	1720	-	-
132	2	-	-	2285	1840	2285	1840	2100	1700	2100	1700
	4	-	-	2860	2300	2860	2300	2720	2170	-	-
	6	-	-	3320	2670	3320	2670	3100	2420	-	-
160	2	-	-	2800	2240	2800	2240	2650	2120	2650	2120
	4	-	-	3450	2270	3450	2270	3300	2600	-	-
	6	-	-	4000	3200	4000	3200	3750	2900	-	-
180	2	-	-	-	-	-	-	3300	2700	3300	2700
	4	-	-	-	-	-	-	4200	3400	4200	3400
	6	-	-	-	-	-	-	4750	3900	4750	3900
200	2	-	-	-	-	-	-	5000	4200	5000	4200
	4	-	-	-	-	-	-	6330	5320	6330	5320
	6	-	-	-	-	-	-	7250	6080	7250	6080
225	2	-	-	-	-	-	-	5650	4800	5650	4800
	4	-	-	-	-	-	-	6950	5600	6950	5600
	6	-	-	-	-	-	-	7900	6500	7900	6500
250	2	-	-	-	-	-	-	6700	5600	6700	5600
	4	-	-	-	-	-	-	8500	7000	8500	7000
	6	-	-	-	-	-	-	9500	7800	9500	7800
280	2	-	-	-	-	-	-	11500	9500	11500	9500
	4	-	-	-	-	-	-	17000	14000	17000	14000
	6	-	-	-	-	-	-	20000	17000	20000	17000
315	2	-	-	-	-	-	-	14600	12300	14600	12300
	4	-	-	-	-	-	-	20000	16500	20000	16500
	6	-	-	-	-	-	-	23000	19000	23000	19000
355	2	-	-	-	-	-	-	15800	14000	15800	14000
	4	-	-	-	-	-	-	22000	19000	22000	19000
	6	-	-	-	-	-	-	25000	22000	25000	22000

Terminal box



The terminal box is located on the top of the motor housing as standard, and can be rotated by 4 x 90° – on some 1LE1 even 360° – to allow for cable entry from each direction.

All terminal boxes have two cable entries sealed by a screwed plug.



1LA7

Frame size	Aluminum Series				
	Efficiency IE1				
	1LA7				
	Number of terminals	Contact screw thread	Max. connectable cross-section (mm ²)	Outer cable diameter (sealing range)	Cable entry size (screwed plug)
63	6	M4	1.5	9 ... 17	1xM25x1.5 + 1xM16x1.5
71	6	M4	1.5	9 ... 17	1xM25x1.5 + 1xM16x1.5
80	6	M4	1.5	9 ... 17	1xM25x1.5 + 1xM16x1.5
90	6	M4	1.5	9 ... 17	1xM25x1.5 + 1xM16x1.5

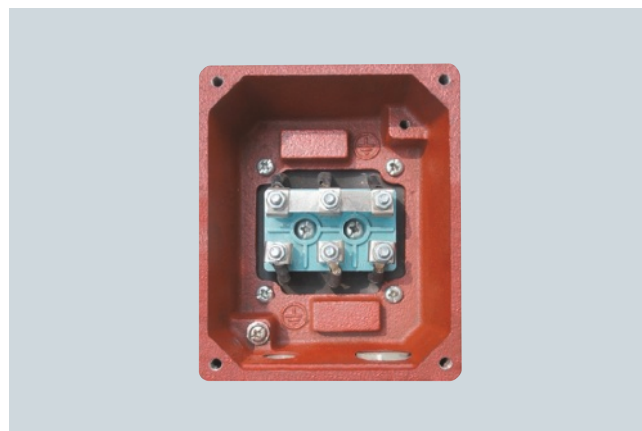


1LE10

Frame size	Aluminum Series									
	Efficiency IE1					Efficiency IE2				
	1LE1002					1LE1001				
	Number of terminals	Contact screw thread	Max. connectable cross-section (mm ²)	Outer cable diameter (sealing range)	Cable entry size (screwed plug)	Number of terminals	Contact screw thread	Max. connectable cross-section (mm ²)	Outer cable diameter (sealing range)	Cable entry size (screwed plug)
80	–	–	–	–	–	6	M3.5	1.5	9 ... 17	1xM25x1.5 + 1xM16x1.5
90	–	–	–	–	–	6	M3.5	1.5	9 ... 17	1xM25x1.5 + 1xM16x1.5
100	6	M4	4	11 ... 21	2xM32x1.5	6	M4	4	11 ... 21	2xM32x1.5
112	6	M4	4	11 ... 21	2xM32x1.5	6	M4	4	11 ... 21	2xM32x1.5
132	6	M4	6	11 ... 21	2xM32x1.5	6	M4	6	11 ... 21	2xM32x1.5
160	6	M5	16	19 ... 28	2xM40x1.5	6	M5	16	19 ... 28	2xM40x1.5

Motors with an aluminum housing are particularly user friendly. The terminal box introduced for frame sizes 100 to 160 has proven its worth and is consistently implemented throughout the motor series for 2- and 4-pole motors of frame sizes 80 and 90.

The terminal box is only fixed with one screw and can be rotated steplessly by up to 360°. The terminal box is also preconfigured with a terminal board. This makes installation quicker and easier in confined spaces as the motor connection cables can be fed in from any direction.



1LE0

Frame size	Cast Iron Series									
	Efficiency IE1					Efficiency IE2				
	Number of terminals	Contact screw thread	1LE0102			1LE0101			Number of terminals	Contact screw thread
Max. connectable cross-section (mm ²)			Outer cable diameter (sealing range)	Cable entry size (screwed plug)	Max. connectable cross-section (mm ²)	Outer cable diameter (sealing range)	Cable entry size (screwed plug)			
80	6	M4	1.5	13 ... 18	M25 x 1.5 + M16 x 1.5	6	M4	1.5	13 ... 18	M25 x 1.5 + M16 x 1.5
90	6	M4	1.5	13 ... 18	M25 x 1.5 + M16 x 1.5	6	M4	1.5	13 ... 18	M25 x 1.5 + M16 x 1.5
100	6	M4	4	18 ... 25	M32 x 1.5 + M32 x 1.5	6	M4	4	18 ... 25	M32 x 1.5 + M32 x 1.5
112	6	M4	4	18 ... 25	M32 x 1.5 + M32 x 1.5	6	M4	4	18 ... 25	M32 x 1.5 + M32 x 1.5
132	6	M4	6	18 ... 25	M32 x 1.5 + M32 x 1.5	6	M4	6	18 ... 25	M32 x 1.5 + M32 x 1.5
160	6	M5	16	22 ... 32	M40 x 1.5 + M40 x 1.5	6	M5	16	22 ... 32	M40 x 1.5 + M40 x 1.5
180	6	M5	16	22 ... 32	M40 x 1.5 + M40 x 1.5	6	M5	16	22 ... 32	M40 x 1.5 + M40 x 1.5
200	6	M6	25	32 ... 38	M50 x 1.5 + M50 x 1.5	6	M6	25	32 ... 38	M50 x 1.5 + M50 x 1.5
225	6	M8	35	32 ... 38	M50 x 1.5 + M50 x 1.5	6	M8	35	32 ... 38	M50 x 1.5 + M50 x 1.5
250	6	M10	120	37 ... 44	M63 x 1.5 + M63 x 1.5	6	M10	120	37 ... 44	M63 x 1.5 + M63 x 1.5
280	6	M10	120	37 ... 44	M63 x 1.5 + M63 x 1.5	6	M10	120	37 ... 44	M63 x 1.5 + M63 x 1.5
315	6	M12	240	37 ... 44	M63 x 1.5 + M63 x 1.5	6	M12	240	37 ... 44	M63 x 1.5 + M63 x 1.5
355	6	M20	240	44 ... 57	M72 x 2 + M72 x 2	6	M20	240	44 ... 57	M72 x 2 + M72 x 2

SIMOTICS General Purpose Low-Voltage Motors 1LE0 option line

The **1LE0 option line** is a new set of motors offering extended options and voltages based on the 1LE0 motor family. This broadens the 1LE0 portfolio to fulfill a wider range of requirements for motor specifications in different environments and applications. **The article number of the 1LE0 option line (1LE002) is different to the 1LE0 distribution line (1LE010).** The basic motor of the 1LE0 option line is a standard motor without any included features. A wide range of options can be added into the configuration as needed. As a highlight, options like **PTC, condensation drain hole and bearing for increased cantilever force** are included as standard in the 1LE0 distribution line only.

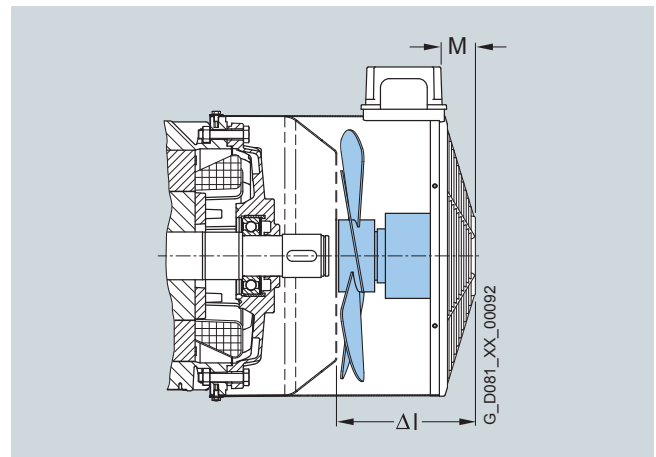
Additional options of the 1LE0 option line are designed to suit the different requirements of the customer. They also enhance the distribution portfolio to project specifications and specific OEM machines.

1LE0 option line for general industrial applications

Frame size	80 to 355
Power range	0.55 kW to 315 kW (referred to 1,500 rpm rated speed)
Number of poles	2, 4 and 6 poles
Motor material	Frame and terminal box: Cast iron
Article number and Efficiency class	1LE0022: IE1 Improved efficiency 1LE0021: IE2 High efficiency
Voltages	230 V to 690 V, selectable according list of voltage codes
Insulation system	Direct-on-line operation upto 690 V, Converter-fed upto 460 V + tolerance
Temperature class	155 (F) utilization to 130 (B)
Ambient temperature	Standard – 20 °C to + 40 °C , optional – 40 °C to + 40 °C
Construction type	Standard IMB3 and other types of construction as option
Degree of protection	IP55, optional IP56
Winding protection	Optional PTC, PT100 and KTY84-130
Modular concept	Encoder and separated driven fan as option



LL 861 900 220 encoder, Option G04



Separately driven fan, Option F70

Product highlights

1. Wide range of options – can be selected according to specific customer requirements. The basic 1LE0 option line motor is a standard motor without any built-in features.

2. Fulfill voltage and construction requirements – The motor line offers additional selection of rated voltages and mounting types.

3. Easy retrofit and upgrade – due to harmonized design dimensions throughout the whole 1LE0 motor family.

4. Common user and spare parts – are applicable within the 1LE0 motor line.

5. Increase plant and system availability – Options of winding protection, insulated bearing and separately driven fan enhance the availability and thus reliability of the system.

6. Global support – worldwide warranty and service

Application note

- **Pump:** Energy saving for quadratic torque load with variable speed operation
- **Fan:** Ideal for flow control application
- **Material handling:** Effectively working with continuous and intermittent periodic duties. Reliable operation.



Pump



Fan

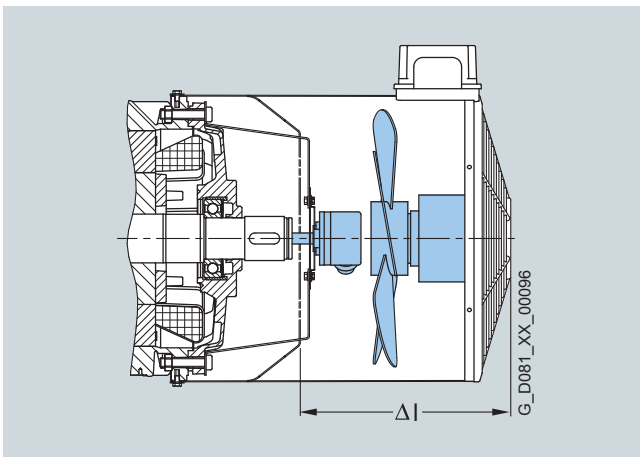
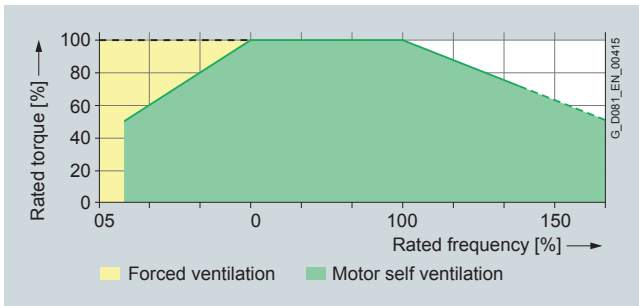


Material handling

Flexible control options

With separately driven fan, the motor can be worked with inverter in constant torque operation. This is the result of continuous full speed ventilation of forced fan option.

Working with SINAMICS, you can rely on a drive family with flexible control options – with V/f control as well as vector control. As a result, applications can be addressed with basic speed control and with higher speed precision with encoderless vector control or with encoder.



Motor with encoder and separated driven fan

Highlight features



Highlight motor options

- **Insulated bearing, encoder and separately driven fan** to increase reliability for converter-fed operation
- **KTY84-130 and PT100 sensors** are additional protections that can evaluate motor temperature for alarm and tripping.
- **Measuring nipple** for SPM shock pulse measurement for bearing inspection
- **Vibration severity level B** according to IEC 60034-14
- **Rotation of terminal box** on right or left hand side of the motor drive end
- **Additional degree of protection IP56**

Article number explanation

Structure of Article No. (1LE0 option line)

Structure	Position: 1 2 3 4 5 6 7 - 8 9 10 11 12 - 13 14 15 16 - Z
<u>Position 1 to 6:</u>	Low-voltage motor series <ul style="list-style-type: none"> • 1LE0 option line
<u>Position 7:</u>	Motor efficiency <ul style="list-style-type: none"> • Motor with high efficiency - IE2 • Motor with improved efficiency - IE1
<u>Position 8 to 11:</u>	Frame size, number of poles and frame length Refer to page 14
<u>Position 12 and 13:</u>	Voltage, circuit and frequency <ul style="list-style-type: none"> • 22 = 230 VD/400 VY 50 Hz • 34 = 400 VD/690 VY 50 Hz • 35 = 415 VD 50 Hz • 21 = 220 VD/380 VY 50 Hz • 33 = 380 VD/660 VY 50 Hz • 90 = special voltage & frequency • 23 = 240 VD/415 VY 50 Hz • 41 = 525 VD 50 Hz
<u>Position 14:</u>	Type of construction (refer to page 17) <ul style="list-style-type: none"> • A = IM B3 • J = IM B35 • F = IM B5 • G = IM V1 • K = IM B14 • T = IM B6 • U = IM B7 • V = IM B8 • C = IM V5 • D = IM V6 • N = IM B34 • M = IM V18 • L = IM V19 • W = IM V15 • Y = IM V35 • G = IM V1 • H = IM V3
<u>Position 15:</u>	Motor protection <ul style="list-style-type: none"> • A = without winding protection • B = 3 PTC thermistors for tripping • C = 6 PTC thermistors for alarm and tripping • F = 1 temperature sensor KTY 84-130 • H = 3 resistance thermometers Pt100 • J = 6 resistance thermometers Pt100
<u>Position 16:</u>	Terminal box location (view from drive end) <ul style="list-style-type: none"> • 4 = on top • 5 = on RHS • 6 = on LHS
	Special order version Coded - Order (option) code also required

Ordering example

1LE0021 – 1DB43 – 4AH4-Z, F70+B02

1LE0 option line motor, IE2 high efficiency motor, FS160, 4 poles, 400 VD/690 VY 50 Hz, IM B3, 3 resistance thermometers PT100, terminal box on top included separated driven fan (F70) and Acceptance test certificate 3.1 in accordance with EN 10204 (B02).

List of options

Remark: The basic 1LE0 extended option motor does not include any option as standard.

Motor frame size	Position of article No. 12 th & 13 th	Option code ¹⁾	Description
Voltage and frequency			
FS80 ~ 132	21		220 VD / 380 VY 50 Hz ²⁾
FS100 ~ 355	33		380 VD / 660 VY 50 Hz ²⁾
FS80 ~ 132	22		230 VD / 400 VY 50 Hz ²⁾
FS100 ~ 355	34		400 VD / 690 VY 50 Hz ²⁾
FS80 ~ 355	23		240 VD / 415 VY 50 Hz
FS80 ~ 355	35		415 VD 50 Hz
FS80 ~ 355	41		525 VD 50 Hz
FS80 ~ 355	90	M2A	220 VD / 380 VY 60 Hz (50 Hz output)
FS80 ~ 355	90	M2B	380 VD 60 Hz (50 Hz output)
FS80 ~ 355	90	M2C	440 VY 60 Hz (50 Hz output)
FS80 ~ 355	90	M2D	440 VD 60 Hz (50 Hz output)
FS80 ~ 355	90	M2E	460 VY 60 Hz (50 Hz output)
FS80 ~ 355	90	M2F	460 VD 60 Hz (50 Hz output)
Motor frame size	Position of article No. 15 th	Option code ¹⁾	Description
Motor protection			
FS80 ~ 355	A ²⁾		Without motor protection
FS80 ~ 355	B		Motor protection with PTC thermistors with three embedded temperature sensors for tripping
FS80 ~ 355	C		Motor protection with PTC thermistors with 6 embedded temperature sensors for alarm and tripping
FS100 ~ 355	F		Motor temperature detection with embedded temperature sensor KTY 84-130
FS80 ~ 355	H		Installation of three PT100 resistance thermometers
FS80 ~ 355	J		Installation of six PT100 resistance thermometers
Motor frame size	Position of article No. 16 th	Option code ¹⁾	Description
Motor terminal box			
FS80 ~ 355	4		Terminal box top
FS80 ~ 355	5		Terminal box on RHS
FS80 ~ 355	6		Terminal box on LHS
FS80 ~ 355		R10 ³⁾	Rotation of the terminal box through 90°, entry from DE
FS80 ~ 355		R11	Rotation of the terminal box through 90°, entry from NDE
FS80 ~ 355		R12	Rotation of the terminal box through 180°
FS80 ~ 355		H08 ⁴⁾	Terminal box on NDE
Winding and Insulation			
FS80 ~ 355		N01	Temperature class 155 (F), used acc. to 155 (F), with service factor (SF)
FS80 ~ 355		N10	Temperature class 180 (H)
FS80 ~ 355		Q04	Anti-condensation heating for 220 V
FS80 ~ 355		Q02	Anti-condensation heating for 230 V



In the basic bearing system, the located bearing is at the NDE or the bearing at the NDE is fixed. And the bearing at the DE is free or “floating”. Therefore it allows thermal (axial) growth of the shaft. In case of pump application with vertical mounting, the axial and trust load have to be considered and L20 option, located bearing at DE, is recommended.

Motor frame size	Option code ¹⁾	Description
Bearing		
FS100 ~ 355	L22	Bearing design for increased cantilever forces
FS80 ~ 160	L20	Located bearing DE
FS100 ~ 250	L23 ⁵⁾	Regreasing device
FS180 ~ 355	Q72	Installation of 2 PT100 screw-in resistance thermometers for bearings
FS250 ~ 355	L53 ⁶⁾	Insulated bearing
FS100 ~ 355	Q01	Measuring nipple for SPM shock pulse measurement for bearing inspection
Balance and vibration quantity		
FS80 ~ 355	L00	Vibration quantity level B
Mechanical design and degree of protection		
FS80 ~ 355	L05 ⁷⁾⁸⁾	Second standard shaft extension, NDE
FS80 ~ 355	H00 ⁹⁾	Protective cover (canopy)
FS80 ~ 355	H03 ¹⁰⁾	Condensation drainage holes
FS80 ~ 280	H04 ¹¹⁾	External earthing
FS80 ~ 355	H22	IP56 degree of protection (non-heavy-sea)
Modular technology		
FS80 ~ 355	F70 ¹²⁾	Mounting of separately driven fan
FS80 ~ 355	F90 ¹³⁾	Without external fan and without fan cover
FS80 ~ 355	F76	Metal fan
FS112 ~ 355	G04	Mounting of LL 861 900 220 rotary pulse encoder
Rating plate and test certificates		
FS80 ~ 355	B02	Acceptance test certificate 3.1 according to EN 10204
Paint finish		
FS80 ~ 355	S01	Unpainted, only primed
Coolant temperature		
FS80 ~ 355	D03	Coolant temperature –40 to +40 °C

1) Article No. supplement Z with option code when ordering.

2) Without additional charge.

3) For FS80 to 112 motor, R10 only in combination with option code H08 (Terminal box on NDE) possible.

4) Cable entry on terminal box towards the non-drive end.

5) FS280, FS315 and FS355 motor with the regreasing device as standard.

6) For horizontal mounting motor, the insulated bearing is located at NDE. For vertical mounting motor, the insulated bearing is located at DE.

7) Not possible in combination with canopy or separately driven fan (order code: F70).

8) Second standard shaft extension on NDE is smaller than DE and provides output at the level of the next smaller frame size.

9) Only applicable for the construction type IM V5, IM V1, IM V15 and IM V18. Not possible in combination with option code L05.

10) Position of the condensation drainage hole will be adapted to the construction type of the motor accordingly.

11) FS315 and FS355 motor with external earthing as standard.

12) When the separately driven fan is mounted, the length of the motor increases by ΔL .

13) Without fan and fan cover, the length of the motor decreases by Δl . By using the power output of rating plate, the motor must have external cooling by air flow. The correct motor cooling is in responsibility of customer. Missing or wrong cooling reduces the life time or damages the motor.